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Road vehicles — Aerosol separator performance test for internal combustion engines —

Part 1:
General

Véhicules routiers — Essai de performance du séparateur d'aérosols pour les moteurs à combustion interne —

Partie 1: Généralités

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Contents

Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 17536-1 was prepared by Technical Committee ISO/TC 22, *Road Vehicles*, Subcommittee SC 5, *Aerosol Separator performance for internal combustion engines*.

ISO 17536 consists of the following parts, under the general title *Road Vehicles — Aerosol separator performance test for internal combustion engines*:

— *Part 1: General*

— *Part 2: Laboratory gravimetric test method* ［To be published］

— *Part 3: Method to perform engine gravimetric test* ［To be published］

— *Part 4: Laboratory fractional test method* ［To be published］

— *Part 5: Method to perform engine fractional test* ［To be published, Technical Specification］

Introduction

Engine crankcase blow-by is composed of combustion exhaust gases which have escaped to the crankcase via piston ring seals and lube oil aerosols generated by thermal and mechanical action within the engine. These gases must be vented from the crankcase to prevent a build-up of high pressure. The constituents of vented engine blow-by gases are recognized as an undesirable contaminant and technology for their containment is therefore evolving.

The device used to separate oil aerosols from the blow-by typically releases cleaned gases to atmosphere or alternatively returns the cleaned product to the combustion process by feeding into the air inlet prior to the turbo compressor. The latter has lead to the requirement for a pressure control device to isolate the engine from turbo inlet suction.

The engine test methods presented in ISO 17536 are general guidelines for performing an engine test.

Annexes A ~ I of this part of ISO 17536 specify general and common provisions for aerosol separator performance test.

Road Vehicles — Aerosol separator performance test for internal combustion engines — Part 1: General

1 Scope

This part of ISO 17536 specifies general conditions, defines terms and establishes the basic principles for blow-by oil aerosol separator performance tests by laboratory or engine and gravimetric or fractional test method.

Conformance of a device to legislation is outside of the scope of this standard and the appropriate regulations must be consulted.

2 Terms, definitions, symbols and units

For the purposes of all parts of ISO 17536, the following terms and definitions apply.

2.1 Terms and definitions

2.1.1
blowby
aerosol produced from engines and released through a crankcase vent

2.1.2
oil carryover
total amount of liquid oil captured in the downstream wall flow trap

2.1.3
filter element
replaceable part of the crankcase system, consisting of the filter material and carrying frame

2.1.4
crankcase ventilation system
device which separates oil and particles from the engine blowby before venting to either the engine (CCV) or the environment (OCV)

2.1.5
differential pressure
difference in static pressure measured immediately upstream and downstream of the unit under test

2.1.6
pressure loss
measure of the loss of aerodynamic energy caused by an aerosol separator at the observed air flow rate due to different flow velocities at the measuring point.

NOTE 1 It is expressed as the differential pressure corrected for any difference in the dynamic head at the measuring points

NOTE 2 For further information, See Annex A.

2.1.7
wall flow trap
device to capture oil that is flowing along the walls

NOTE The wall flow trap design is drawn in Figure I.2.

2.1.8
absolute filter
filter downstream of the unit under test to retain the contaminant passed by the unit under test

2.1.9
piezometer tube
duct that has a hole or holes drilled in the wall to obtain a pressure reading

NOTE For further information, see Annex B, Figure B.2.

2.1.10
separator efficiency
ability of the aerosol separator or the unit under test to remove contaminant under specified test conditions

2.1.11
optical (equivalent) diameter
$D_{o,i}$
diameter of a particle of the type used to calibrate an optical sizing instrument that scatters the same amount of light as the particle being measured

NOTE Optical diameter depends on the instrument, the type of particle used to calibrate the instrument (usually polystyrene latex spheres), and the optical properties of the particle being measured.

2.1.12
aerodynamic (equivalent) diameter
D_{ae}
diameter of a sphere of density 1 g/cm^3 with the same terminal velocity due to gravitational force in calm air, as the particle being measured

NOTE 1 Annex C provides additional information about aerodynamic diameter.

NOTE 2 Aerodynamic diameter depends on the instrument, the type of particle used to calibrate the instrument (usually polystyrene latex spheres), and the properties of the particle being measured.

2.1.13
pressure regulator
device between the outlet of the aerosol separator and air intake to regulate the crankcase pressure in high vacuum conditions

2.1.14
mass oil flow
mass amount of oil per unit time

2.1.15
relief valve
device to direct a portion of the flow around a separation device due to a pressure difference, usually venting to the atmosphere

2.1.16
bypass valve
device to direct a portion of the flow around a separation device due to pressure difference, usually venting downstream of the bypassed separation device

2.1.17
challenge aerosol
output from the aerosol generator or engine which corresponds to the distribution in testing and with the amount of the mass feed rate.

NOTE The aerosol distribution by mass is prescribed in ISO 17536-2.

2.1.18
particle size
polystyrene latex (PSL) equivalent size expressed as a diameter in micrometers

2.1.19
isokinetic sampling
sampling in which the flow in the sampler inlet is moving at the same velocity and direction as the flow being sampled.

NOTE Annex D provides additional information about isokinetic sampling.

2.1.20
particle counter
instrument for sizing and/or counting aerosol particles

NOTE 1 Recommended particle counters are optical particle counters (OPC/OAS as per ISO 21501-1) or other counters demonstrating good correlation in measuring particle sizes such as aerodynamic particle counters (APC).

2.1.21
coefficient of variation
COV
standard deviation of a group of measurements divided by the mean

2.1.22
unit under test
UUT
either a single aerosol separator element or a complete crankcase ventilation system

2.1.23
open crankcase ventilation
OCV
aerosol separator system that is attached to the crankcase and is vented to the environment

2.1.24
closed crankcase ventilation
CCV
aerosol separator system that is attached between the crankcase and the engine

2.1.25
aerosol separator
device that separates oil from the blowby stream or test stand airstream

2.1.26
high efficiency particular air filter
HEPA filter
filter having 99,95 % efficiency at most penetrating particle size (class H13 in accordance with EN 1822), or 99,97 % (or higher) fractional efficiency at 0,3 μm using DOP aerosol as defined by IEST RP-CC001 recommended practice

2.1.27
inertial separator
device that separates oil from the blowby stream using inertia

2.1.28
combination separator
device that separates oil from the blowby stream using inertia as well as a filter element

2.1.29
rated air flow
flow rate specified by the user or manufacturer

NOTE The rated air flow is usually used as the test air flow.

2.1.30
test air flow
measure of the quantity of air pushed or drawn through the aerosol separator per unit time

2.1.31
aerosol generator
laboratory equipment that can produce a simulated blowby particle distribution from oil and compressed air

NOTE The aerosol distribution by mass will be prescribed in ISO 17536-2.

2.1.32
drainage vessel
device that captures the separated oil from the crankcase separation system, not to include oil carryover

NOTE Filter life is not used in all parts of ISO 17536. Life reference is given in Annex E.

2.1.33
mass feed rate
mass amount of challenge aerosol or liquid subjected to the unit under test per unit time

NOTE Filter life is not used in all parts of ISO 17536. Life reference is given in Annex E.

2.2 Symbols and units

Table 1—Symbols and units

Quantity	Symbol	Unit
Volume flow rate	q_V	l/min
Velocity	v	m/s
Density	ρ	kg/m^3
Mass flow rate	q_m	g/hr
Pressure	p	Pa
Differential pressure	Δp_d	Pa
Pressure loss	Δp_l	Pa
Mass	m	g
Time	t	s
Speed	N	rev/min
Torque	T	N-m

3 Measurement equipment accuracy

Air flow rate to within ± 5 % of reading.